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United States Department of Agriculture,
DIVISION OF ENTOMOLOGY.

THE SQUASH-VINE BORER.

(*Melittia satyriniformis* Hbn.)*

GENERAL APPEARANCE AND METHOD OF WORK.

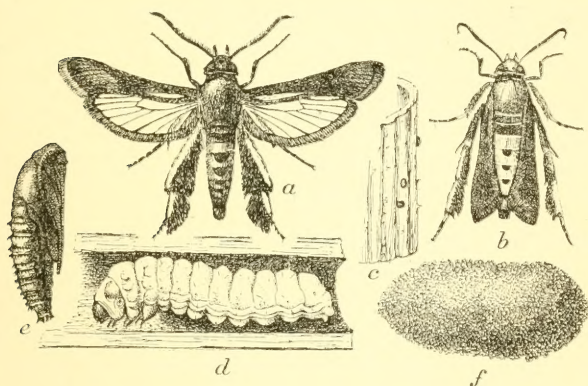


FIG. 1.—*Melittia satyriniformis*: a, male moth; b, female, with wings folded in natural position when at rest; c, eggs shown on bit of squash stem; d, full-grown larva, *in situ* in vine; e, pupa; f, pupal cell—all one-third larger than natural size (author's illustration).

One of the most troublesome of the many enemies of squashes, pumpkins, and other cucurbits is the squash-vine borer. In many localities this species surpasses all other squash insects in point of injuriousness.

Damage is due to the larvæ boring through the stems, causing them to rot at the affected points and become severed from the vine, or so injuring the vine as to cause the leaves to wilt and the plant to die. The presence of the borer feeding within the stem is not apparent at the commencement of the attack, but soon becomes manifest through the presence of the yellowish powdery excrement which it forces from its burrow in the stem and which accumulates

* Until recently this species was generally known as *Melittia ceto*, or *cucurbitæ*. For the reason of the change of name see writer's article published in Bul. 19, n. s., Div. Ent., p. 38.

on the ground beneath, as well as by the sudden wilting and dying down of the leaves. Wilting occurs soon after the larvæ have made considerable growth within. From one to half a dozen or more larvæ inhabit a stem, and often upwards of forty individuals have been taken from a single plant; indeed, one grower has stated that he once cut "142 larvæ from a single vine." The larvæ work with great rapidity and in a very short time are able to injure a plant so that no fruit will mature. Injury is most noticeable near the bases of the stems, where in course of time the vine becomes severed from the roots and the whole vine dies.

The parent of this insect is a beautiful creature, a medium-sized moth of the family Sesiidæ, or clear-winged moths. The fore-wings are opaque, lustrous olive-brown in color, with metallic green reflections, and expand from less than an inch to nearly an inch and a half. The hind-wings are transparent and veined as shown in the accompanying illustration of the male (fig. 1, *a*). The abdomen is conspicuously marked with orange or red, black and bronze, and the hind legs are fringed with long hairs, red or orange on the outer surface and black inside. The natural position of the moth when at rest is shown by the figure of the female (*b*).

DISTRIBUTION.

As far as known this species is a native of the Eastern Hemisphere, and widely distributed and injurious in the United States practically wherever squashes are cultivated. Available records and examination of material in the collection of the U. S. National Museum show that it has a range, embracing territory from the New England States and Canada in the north, to the Gulf States southward, and westward to the region beyond the Missouri River, which comprises the major portion of the Carolinian and Austroriparian regions of the Upper and Lower Austral and a portion also of the Transition life zones. Injury has been observed to be particularly severe in recent years on Long Island and in New Jersey, Delaware, Maryland, Virginia, and the District of Columbia in the east, and in Kansas and Nebraska in the west. Other States in which injury has been noted include Maine, Massachusetts, Connecticut, Rhode Island, Georgia, Alabama, Mississippi, Louisiana, Iowa, and Michigan. It is evidently of tropical origin, and occurs in Mexico, where it is also widely distributed, in Guatemala, Panama, Venezuela, Argentine, and the Lower Amazon.

FOOD HABITS.

The vines of squash and pumpkin form the chief food supply of this species, but occasionally it attacks also gourd, muskmelon, and cucumber. It does not, however, in the writer's experience, attack

melons and cucumbers when the other preferred crops are available. The larvæ bore through the stems from the roots to the base of, and even through, the leaf-stalks, and sometimes attack the fruit both of squash and muskmelon. Larvæ have also been observed on the wild balsam apple (*Echinocystis lobata*), which is probably a natural food plant.

Injury is greatest to Hubbard, marrow cymblins, and other late varieties of squash, and is apt to be more acutely felt in small gardens than when crops are grown for market. Even if the plant survives attack it may not bear fruit, and often the grower loses a large proportion of his crop year after year. Not infrequently entire crops are destroyed.

NATURAL HISTORY.

This species is injurious only in the larval form. Although the larvæ are familiar objects to all squash growers, the moths are not generally recognized as the parents of these pernicious borers.

The moths, unlike most others, fly only during the daytime and in the heat of the day. Toward twilight they become less active and may be seen sitting quietly on the leaves of their host plants. Both when in flight and when at rest the moths are singularly wasp-like in appearance.

Time of appearance of the moth.—Approximately it may be stated that the moth appears as soon as the vines are sufficiently advanced to serve for oviposition and the subsequent subsistence of the borer larvæ within their stems. Indications are that as far south as the District of Columbia the moths make their first appearance in the field sometime in May or at least early in June, as larvæ nearly matured have been found by the middle of July. In New Jersey, according to Dr. J. B. Smith, the moths are abroad at or soon after the beginning of June; on Long Island from the middle to the last of June. In Massachusetts, according to Harris, they appear about the plants the second week in July. We thus have considerable variation in time of earliest appearance dependent upon season and locality, a variation to be expected in a species of so wide a range.

The egg and oviposition.—The eggs, which are oval and dull red in color, are laid upon all parts of a plant, from the roots to the buds and petioles, but chiefly along the stems, though in some varieties of squash, it is said, nearer the base of the stem than otherwise. Oviposition is very rapid, the moth flitting from hill to hill leaving an egg in each. A single moth may lay as many as 212 eggs. The eggs hatch in from six to fifteen days after they are deposited, and the larvæ are said to attain full growth four weeks or more later. This period will undoubtedly vary in different temperatures according to the season of the year when oviposition takes place.

Eggs are shown a little larger than natural at *c* of figure 1, and much magnified at *a* and *b* of fig. 2, *c* showing the sculpture.

The larva.—The larva is a soft, whitish, grub-like caterpillar of nearly cylindrical form, with a small, dark head and a few very sparse hairs on each segment. Larvæ in the earlier stages of growth are illustrated by *d*, *e*, and *f*, of fig. 2. A full-grown larva is shown in profile within an open stem at fig. 1, *d*, and the head and first two thoracic segments appear in fig. 2 at *g*. Mature larvæ measure about an inch (25 mm.). In the District of Columbia full-grown larvæ, as already observed, occur as early as June 16; in New Jersey late in July, and are to be found upon the vines in different stages in October; at Washington as late as the second week of November.

After attaining maturity the larvæ desert the stems and enter the earth, burying themselves to the depth of one or two inches, and form their cocoons in which they transform to pupa. The cocoon (shown at *f*, fig. 1) is constructed of silk and coated externally with fine particles of earth which adhere by means of some gummy secretion of the larva.

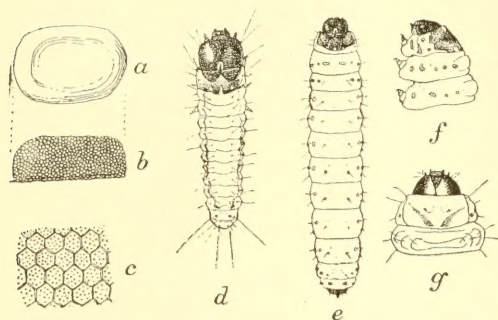


FIG. 2.—*Melittia satyriniformis*: *a*, egg as seen from above; *b*, same from the side showing sculpture; *c*, sculpture of egg greatly enlarged; *d*, newly-hatched larva; *e*, half-grown larva; *f*, head of same from side; *g*, head of mature larva from above; *a*, *b*, and *d*, much enlarged; *e*, *f*, and *g*, less enlarged. (Author's illustration).

The pupa or chrysalis (shown in profile at *e*, fig. 1) measures about $\frac{5}{8}$ inch in length (16 mm.). It is shining mahogany brown in color and its head is orna-

mented in front just above and between the eyes with a horn-like process. By means of this the pupa cuts its way out of one end of its cocoon and by the aid of the abdominal hook-like spines forces itself to the surface of the earth before transforming to imago.

Number of generations.—The question of the number of generations produced annually in the different temperature localities which this insect inhabits has been solved by recent observation, the results serving to indicate that it is practically single-brooded on Long Island and northward; that there is a tendency to two broods in New Jersey, the moths in exceptional cases completing their transformations late in August or September; that in the latitude of the District of Columbia the species is partially double-brooded, a larger portion of the moths, we may assume, developing as a second generation here than in New Jersey; and that in the Gulf States this species is undoubtedly fully two-brooded.

PREVENTIVE AND REMEDIAL MEASURES.

This borer is an exceptionally difficult insect to control, as ordinary insecticides are of no value against it after the insect has once entered the vines, and repellents are also practically useless. We are, therefore, dependent upon cultural methods for relief.

Knowing, as we do, that the insect passes the winter in the fields which it has ravaged, it should be superfluous to caution growers not to plant squashes in the same ground in successive years.

Early squashes as traps.—Good results have been obtained by planting as a trap crop and as early as possible a few summer squashes, such as crooknecks and early cymblins, before, and between rows of, the main crop of late varieties. The summer squashes attract the insects in such numbers as to leave a smaller number to deal with upon the late or main crop. As soon as the early crop is gathered, or earlier if the ground is needed for the main crop, the vines are promptly raked up and burned to destroy all eggs and larvæ which they may harbor, and the same treatment is followed after gathering the late varieties. This method, according to Dr. Smith, has proved profitable where used in New Jersey, and should produce good results farther north. Southward where two well-defined broods appear it might not be so productive of good, but it should be given a thorough test.

Fall harrowing and deep spring plowing.—Experiments recently conducted by Mr. F. A. Sirrine of the New York Agricultural Station at Geneva, N. Y., show that this species can be greatly reduced by lightly harrowing the surface of infested squash fields in the fall so as to bring the cocoons of the vine borer to the surface, where they will be exposed to the elements, and then plowing in the spring to a uniform depth of at least six inches so that the adults will not be able to issue.

Other cultural methods.—When the vines have attained some length parts of them should be covered over with earth so that secondary roots will be sent out to support the plants in case the main root is injured by the borer. Keeping the plants in good condition, free from disease and other insects, and well nourished, with the assistance of manure or other fertilizer if necessary, will also aid the plants to withstand borer attack. When vines are so badly infested as to be incapable of bearing fruit they die usually at once, and they should then be promptly taken out and burned. The old vines should also be destroyed as soon as the crop is made.

Cutting out the borers.—The old-time remedy of cutting the borers out of the vines, although laborious, is of value, and about the only method open for employment after they have entered the vines. As several individuals often infest a single vine, it is best to cut longitudinally, so as not to sever the vine from the root stalk.

If the wound made by cutting be afterward covered with moist soil it will assist it to heal. The location of the borer in the vine can readily be detected by the accumulation of its yellow "frass" or excrement at the point where it is working, and which is kept open for the extrusion of this matter.

Capturing the moths.—This species may be held in partial subjection by keeping a sharp lookout for the parent moths, which are readily seen and not difficult of capture toward dusk or in the cool of the morning, when they are comparatively inactive. The female may be easily caught, just as she alights on a vine for oviposition.*

Summary.—If the grower would make certain of securing a good crop in localities where this and other enemies of the squash occur in their most destructive abundance, it will be necessary for protection against this borer to observe most of the following precautions, and, if possible, secure the cooperation of his neighbors in their observance:

- (1) Not to plant in or near infested ground.
- (2) To plant early varieties for the protection of late squashes.
- (3) To harrow infested fields lightly in fall and plow deeply in spring, to prevent the moths from issuing.
- (4) To encourage the growth of secondary roots by covering the stems with earth.
- (5) To destroy dead vines and old plants as soon as the crop is made.
- (6) To keep the plants in vigorous condition free from other insects and disease.
- (7) To cut out such borers as may succeed in entering the vines in spite of the employment of other remedial measures.

The capture of the moths before egg deposition is also advisable.

* In proof of the practicability of this, the writer refers to the testimony of Mr. J. V. D. Walker in *Insect Life* (Vol. IV, pp. 271, 272).

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Approved:
JAMES WILSON,
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